Observations and Reports (*continued*).

Paris:—Service Hydrographique de la Marine. Annales Hydrographiques. Sér. 2. Année 1890. 8vo. *Paris.* The Service.

Service Hydrométrique du Bassin de la Seine. Résumé des Observations Centralisées pendant l'Année 1889. 8vo. *Versailles* 1890; Observations sur les Cours d'Eau et la Pluie Centralisées pendant l'Année 1889. Folio. *Versailles.* The Service.

West Point, N.Y.—U.S. Military Academy. Official Register. 1890. 8vo. [*West Point.*] The Academy.

February 5, 1891.

Sir WILLIAM THOMSON, D.C.L., LL.D., President, in the Chair.

The Right Hon. William Lawies Jackson, whose certificate had been suspended, as required by the Statutes, was balloted for and elected a Fellow of the Society.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

I. "On the Chief Line in the Spectrum of the Nebulæ." By J. NORMAN LOCKYER, F.R.S. Received December 18, 1890.

[Publication deferred.]

II. "On the Chief Line in the Spectrum of the Nebulæ. A Reply." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S. Received February 5, 1891.

[Publication deferred.]

III. "On a Membrane lining the Fossa Patellaris of the Corpus Vitreum." By T. P. ANDERSON STUART, M.D., Professor of Physiology in the University of Sydney, N.S.W. Communicated by Professor SCHÄFER, F.R.S. Received January 12, 1891.

The 9th edition of Quain's 'Anatomy,' 1882, after giving a description of the hyaloid membrane and its connexions, says, "According to the account usually given, the hyaloid membrane divides in front into two layers: an anterior, continued forwards as the zonule of Zinn, and a posterior, passing behind the lens, the canal of Petit being contained between them. The above description is based upon a renewed original investigation into the relations of the structures which support the lens, and is confirmatory of the statements of Meckel, Henle, Brailey, and others, and opposed to those of Iwanoff." Now the description adopted by Quain discards the posterior layer passing behind the lens. The vitreous humour, according to it, lies immediately against the posterior layer of the lens capsule, and at the canal of Petit may, perhaps, in part occupy the interstices of the suspensory fibres, which are said to pass from the zonula to the periphery of the lens capsule. Thus the whole anterior surface of the vitreous is bare, that is, is not invested by any membrane.

I cannot agree with this view, for, in the eye of the ox, I have demonstrated to the satisfaction of large numbers of my students and many members of the medical profession in Sydney, and at the Intercolonial Medical Congress in Melbourne, 1889, that there is undoubtedly a membrane in this situation. I have found it likewise in the eye of the sheep, goat, dog, and porpoise, so that I entertain no doubt of its general occurrence, notwithstanding that Schwalbe, in 1887 ('Anatomie der Sinnesorgane'), adheres to the view of the non-existence of the membrane. This view was more explicitly set forth by Schwalbe in the anatomical part of De Wecker and Landolt's 'Traité complet d'Ophthalmologie' (Paris, 1886). Here, at p. 519, vol. 11, he says what I translate as follows:—

"In the region of the ora serrata the hyaloid begins to gradually thicken and to change its structure, becoming the zonula ciliaris. From this point it constitutes the anterior wall of the canal of Petit; the posterior wall is identical with the anterior surface of the jelly of the vitreous body, which is differentiated from the liquid contents of the canal of Petit merely by its more dense surface. A cleavage of the zonula, near the ora serrata, into an outer leaflet representing the fibres of the zonula and an inner one lining the fossa patellaris does not take place. Consequently the canal of Petit is to be compared to the other clefts in the jelly of the vitreous body. This description

differs from those formerly given by me, in that I now consider the membrane limiting the canal of Petit posteriorly as an artificial product, the result of the action of reagents (by precipitation or condensation). There I agree with Iwanoff. I am bound, however, to maintain, in opposition to Meckel, the existence of the canal of Petit, such as I have described it; that the zonula and the vitreous body appear to touch each other is but the result of the compression which they undergo during section. And so a cleavage of the hyaloid near the ora serrata does not take place." Iwanoff says, "In the vicinity of the ciliary processes the vitreous separates itself from the zonula, so that its entire anterior surface, or that which is turned towards the canal of Petit and the lens, is not covered by any special membrane; neither by a prolongation of the limitans, as stated by Henle, nor by a special membrana hyaloidea, as was formerly supposed." Then, "At the ora serrata the several concentric layers of the cortex (of the vitreous) are so crowded together that the surface of the nucleus is separated from the limitans only by a very thin but plainly fibrous layer. The fibres of this layer run parallel to the surface of the vitreous in wavy bundles, and are not unlike bundles of connective tissues. The entire layer, thus changed, finally turns and passes towards the axis of the eye, thus completely covering the anterior surface of the vitreous. Since we here, in fact, have not a single but several layers crowded together, and only loosely united with one another, it is easy to see how one might suppose that behind the lens there lay a special membrane covering the corpus vitreum, especially since the most superficial of these layers is perfectly smooth." Finally, "The tissue of the vitreous is here condensed to form a limiting layer, in the same manner as Bowman's membrane is formed by a condensation of the substantia propria of the cornea; an independent membrane —the hyaloidea—does not exist at this place."

What occurs to me then, considering the eminence of the authorities on each side of the question, is that the methods of demonstration have not been sufficiently conclusive. After seeing it as I have seen it, and shown it to others, I cannot for one moment doubt its existence, for the proof of its existence could not possibly be more conclusive—it can even be dissected off and examined in any perfectly fresh unaltered ox eye.

As Aeby has already, I find, published, the eyeball is best left to decompose for some twenty-four hours or longer, according to the external temperature, and then, on opening the sclerotic and choroid tissues carefully with fine blunt-pointed scissors, the vitreous and lens, united by the suspensory ligament, drop out in a mass, or at least are very easily expressed. The suspensory ligament is now snipped all round, and the lens in its capsule removed.

When this has been done, according to the one side, the bed of the

lens—the fossa patellaris—and the posterior wall of the canal of Petit (now opened up) would be bounded or lined immediately by the substance of the corpus vitreum. According to the other side—with which I entirely agree—there stretches from side to side a distinct membrane, so that in no part of its extent does the substance of the corpus vitreum reach the surface. Let me now proceed to the proofs, which are of various kinds—chemical, optical, and mechanical.

Chemical Pigments.—Aniline dyes and picrocarmine stain the capsule of the lens, the hyaloid, and other such elastic membranes. When the fresh corpus vitreum is so stained—and I prefer strong picrocarmine for some three minutes, then washing in copious water—the hyaloid is perfectly well seen floating in water, with its wrinkles on distortion and its well-defined free edge at a puncture. Exactly the same appearance is seen on the front of the corpus vitreum—here there is something that stains deeply and that wrinkles. Moreover picrocarmine stains the hyaloid membrane and the vitreous substance differently: the former is red and the latter is yellow. The same difference is seen at the edge of a puncture in the floor of the patellar fossa: the red membrane is quite distinct from the yellow vitreous substance.

Optical.—If, by means of a lens, the sun's rays be concentrated upon the hyaloid membrane, it is seen to have a fluorescent appearance, somewhat as if the surface had been bathed in a solution of quinine sulphate. That this fluorescent appearance is due to the hyaloid is obvious when the concentrated rays are made to fall on a puncture in the hyaloid membrane. The vitreous substance itself has no such appearance, but is clear and glassy, so that the puncture is beautifully seen, and the edge of the hole is sharp and well defined. Exactly the same appearances are obtained when we examine the front of the vitreous; the fluorescence is here too, and the difference between this appearance and that of the vitreous substance showing through the puncture is very marked.

Mechanical.—When a blunt-pointed instrument is gently pressed upon the hyaloid membrane and then removed, the substance recoils simply, perhaps leaving a dimple for a little time; but, on pressing more firmly, there comes an instant when the instrument suddenly sinks; one has the impression that a membrane has been punctured, and that behind the membrane the substance is soft and inelastic. This impression is at once supported on squeezing the mass of the vitreous between the fingers; a little elevation of the vitreous substance is projected like a pimple through the opening in the membrane, and recedes when the pressure is withdrawn. When this is repeated in the front of the vitreous, the results are identical.

So far, I have not mentioned anything which might not be equally well explained by supposing the existence of a dense superficial layer

of the vitreous substance, but the membrane is no such thing; it is a true membrane; it can readily be isolated, stained, submitted to microscopical examination, &c.

Even with the unstained vitreous, it is quite easy to introduce a blunt instrument through a puncture in the membrane and, by working the instrument about under the surface, to detach the membrane from the surface of the vitreous substance.

When this has been done, a bell of air blown under it displays the membrane to good advantage as a delicate, elastic, smooth, apparently structureless, perfectly transparent sheet of tissue, answering most completely to the term "hyaloid." Though delicate, it is yet strong enough to support the whole weight of the vitreous when a blunt instrument is put into it.

When, the bounding membrane remaining intact, the vitreous is squeezed so as to bulge its anterior face, that face does not bulge equally all over its extent. The centre of the anterior face projects more than the peripheral ring. The central projected part corresponds to the fossa patellaris, where, as I shall show, the patellar membrane is thin, while the peripheral ring forms the back wall of the canal of Petit, and here the membrane is comparatively thick. The transition from the peripheral to the central parts is fairly sudden, for the central elevation rises from a distinct line corresponding to the inner margin of the peripheral ring. The canal of Petit is, therefore, a true canal.

If the vitreous be inverted over the mouth of a test-tube (with a hole in the bottom of it) of about $\frac{1}{2}$ inch diameter, and tied over it with a thick silk thread, and afterwards with a rubber band, the superficial part of the hyaloid and greater mass of the vitreous is cut through. If now the vitreous substance be carefully pulled off by forceps, or if the test-tube be set upright in a beaker, and water poured into the beaker, the water rising in the tube will bulge the membrane so that the vitreous substance will drain off it in an hour or so. The membrane thus isolated is toughened by exposure over night, so that such a membrane, though it looks like a mere film, yet sustained no less a pressure than 40 inches of water; others sustained 22, 28, 34 inches, and so on, even after having been dead for days.

If the membrane be snipped all round its periphery, it can be detached as a whole from the subjacent vitreous substance.

When it has been removed, little tags of deeply-staining material are sometimes seen projecting from its deep face; these, I have thought might be vestiges of the hyaloid artery; but, whether these are there or not, there is little or no adhesion between the membrane and the vitreous substance.

When removed, and its deep surface brushed under water to remove any adherent vitreous substance, it is seen to be a hyaloid

membrane with a thin centre and thick periphery. Under the microscope it is structureless. On removal it, of course, stains deeply, and thus can be readily examined.

When one attempts to raise it outwards towards the hyaloid membrane and suspensory ligament, one may succeed as far as the origin of the suspensory ligament, but behind this point it is so firmly adherent to the vitreous substance that it cannot be raised.

The notion of a membrane in front of the vitreous is supported by the behaviour of the vitreous body with its investing membranes intact in water; it will remain many days with its form quite unchanged, and during all this time it may be handled without injuring it. But if the membranes be cut so as to expose the vitreous substance to the action of the water, this substance protrudes and has a cloud-like outline very different from the sharp, definite outline or surface at the uninjured anterior face of the vitreous body where still covered by membrane. Now there is never any of this cloud-like indefinite outline or surface at the uninjured anterior face of the vitreous body. I infer, therefore, that it is not vitreous substance that here comes into contact with the water, but that it is a membrane that is not notably acted on by water.

After all these facts and considerations, I cannot doubt that there is in the perfectly fresh unaltered eye a membranous structure behind the posterior layer of the lens capsule, and that this structure has all the properties of a distinct membrane resembling the hyaloid, but differing in many respects from vitreous substance.

I need say nothing here as to the immense importance in many questions of ophthalmological practice of a definite knowledge of the existence or non-existence of a membrane limiting the vitreous body anteriorly.

[*Note added January* 15, 1891.—Since the above was sent in, I have had an opportunity of examining a series of sections of the entire human eyeball, made by Dr. Sheridan Delépine, and in all of these sections the membrane is distinctly seen *in situ*.]

IV. "On the Connexion between the Suspensory Ligament of the Crystalline Lens and the Lens Capsule." By T. P. Anderson Stuart, M.D., Professor of Physiology in the University of Sydney, N.S.W. Communicated by Professor Schäfer, F.R.S. Received January 12, 1891.

I have not been able to get a too precise statement as to the nature of this connexion, but Quain (9th ed.) says the suspensory ligament is "firmly attached" to the capsule; in another place Quain says it "joins" it. Speaking of "suspensory fibres of the lens," Quain says